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Abstracts

Symposium 4: Signaling pathways and networks

Program/Abstract # 28
Regulation of nodal signaling
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The TGF-beta signals Nodal and Lefty are key regulators of mesoderm and endoderm formation in vertebrates and ES cells. Nodal and Lefty act as long-range, concentration-dependent agonists and antagonists, respectively. Recent studies on the role of microRNAs and protein diffusion in Nodal signaling will be discussed.

doi:10.1016/j.ydbio.2008.05.030

Program/Abstract # 29
Chemokine signaling controls endodermal migration during zebrafish gastrulation
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Germ layers undergo several classic directional movements during gastrulation, including epiboly, involution and convergent-extension. Involuting cells of the mesendoderm also migrate anteriorly, which has largely been interpreted as a consequence of epiboly and convergent-extension. Our experiments reveal a novel role for the chemokine CXCL12b and its receptor CXCR4a in controlling the anterior migration of the endoderm in zebrafish. During gastrulation, *cxcl12b* is expressed by mesodermal progenitors, while *cxcr4a* is expressed by the endoderm. Both *cxcl12b* and *cxcr4a* morphants display bilateral duplications of the liver and pancreas, which we show is caused by a premature anterior migration of endodermal progenitors during gastrulation due to reduced adhesion to the extracellular matrix protein, fibronectin. Our experiments also reveal that chemokine signaling controls the expression and/or clustering of integrin receptors in endodermal cells, providing the first in vivo evidence for chemokines regulating integrins. We propose a novel mechanism in which chemokine expression in the mesoderm holds the endoderm expressing its receptor, creating a tether which ensures that these two cell populations migrate coherently during gastrulation. Loss of this tether causes premature anterior migration of endoderm during gastrulation due to disruption of integrin-mediated cell adhesion. Our results reveal a novel role for chemokine signaling in gastrointestinal morphogenesis providing insights into possible causes of gastrointestinal duplications and ectopic pancreatic/liver tissue in humans.

doi:10.1016/j.ydbio.2008.05.031

Program/Abstract # 30
The engineering of developmental regulation
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In recent years, the gathering and mining of massive datasets (genomes, proteomes, interactomes, phenomes, etc.) has prompted attempts to re-envision biological phenomena as emerging from complex networks and systems, rather than just being the consequence of linear genetic and biochemical pathways. This seems like a step forward, but exactly how it advances understanding is not always easy to see. I will argue that one of the great advantages of the "systems approach" is that it enables one to assign importance to components (e.g. genes, proteins, network circuits) by how they contribute to system-level performance objectives (tasks selected for by evolution), and not merely by how striking or severe the phenotypes are when they are deleted. I will illustrate this by discussing several developing systems in which patterning and growth are the targets of complex regulation. Drawing from recent experimental, mathematical and computational results, I will make the case that only by taking into account selection for engineering objectives–things like robustness, adaptability, response time, and noise-suppression–can we make sense of the molecular and genetic networks we observe. In this regard, biology seems finally to be coming around to a viewpoint articulated over 50 years ago by one of the first presidents of the SDB.

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Program/Abstract # 31
PDLIM5 is required in secreting cells for canonical Wnt signaling
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PDLIM5, also known as Enigma homolog (ENH), is a scaffolding protein with an N-terminal PDZ domain and three C-terminal LIM domains. It is part of the Enigma family of proteins that are well-conserved among chordates, but whose functions in animal models have mostly been unexplored. We present the first animal model experiments defining the function of PDLIM5 and show that it is critical to early development, since its depletion blocks dorsoventral axis formation in the frog. The gene expression knockdown and epistasis experiments we have conducted in *Xenopus laevis* demonstrate that

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